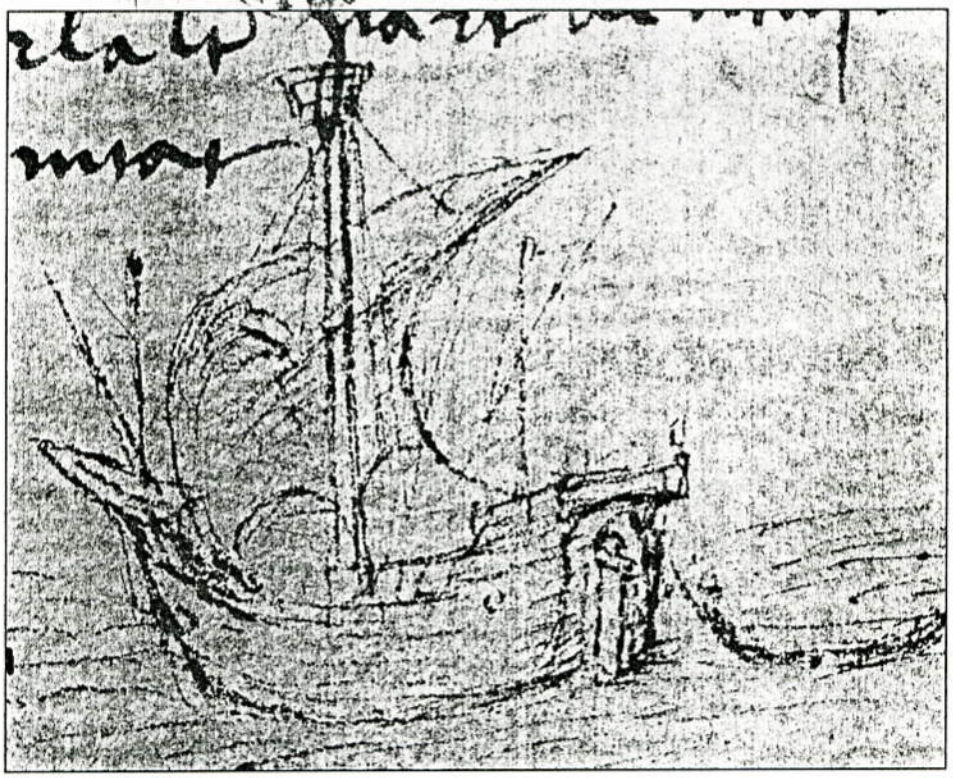
The International Journal of

Nautical Archaeology

Volume 23 Number 1
February 1994

ISSN 1057-2414



Academic Press

London San Diego
New York Boston
Sydney Tokyo Toronto

Published for the
Nautical Archaeology Society

The International Journal of Nautical Archaeology (1994) 23.1: 1–12

Stone anchors from Byzantine contexts in Dor Harbour, Israel

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Introduction

Between January 1990 and October 1991 successive seasonal storms displaced vast quantities of mobile sand at the open-ended southern delineation of the islet chain immediately south of Tel Dor, a promontory which juts into the Mediterranean Sea 13 km north of Caesarea on the Israel coast. In the course of the random sediment fluctuations, a dense concentration of nine shipwrecks and other unrelated harbour debris was sporadically exposed (Fig. 1), confirming prolonged maritime activity in the anchorage from the 13th century BC to the modern day. Detailed excavation was outside the pre-conceived strategy of the research programme and all field-work was therefore restricted to documentation of surface manifestations of the wreckage.

Five sets of single-hole stone anchors were examined with various degrees of detail of intensity. Based on assumptions drawn during the 1990 survey season (when the association between stone anchors and attributes derived from ship's domestic assemblages was considered culturally extraneous), the juxtaposition between the anchors and three Byzantine wreck sites was treated in 1991 as structured and non-coincidental. This change of opinion was induced by the greater exposure of wreckage in the latter year. The four anchors subsequently recorded in detail and lifted to shore are the only examples from within the body of 213 stone anchors and net weights registered at Dor between 1976 and 1991 that are linked to chronologically definable contexts.

The wrecks

Dor wreck No. 7 (DW7/Dor G)

Exposed in 2·2 m of water, Dor G was the deepest wreck deposit located during the surveys and is characterized by closely-set and compact ashlar masonry blocks (surface dimensions 70 × 35 cm) spread over a continuous area of 8·8 × 3·3 m. In January 1990, when the entire perimeter of the site was visible, the outline of the masonry retained the curvilinear shape of a hull.

With the exception of a single amphora top, all residual Byzantine pottery vessels were highly shattered and firmly wedged in crevices between the ballast, alongside clusters of encrusted iron nails. Immediately north of the site, a strongly bent bronze steelyard, 973 mm long and weighing 2·64 kg, and one set of suspension chains (Fig. 2) were flanked on either side by a single stone anchor. The implications of this association remain dubious: soon after the steelyard was recovered, the ever-changing, submerged regime reclaimed the pair of anchors and three others on the southern edge of the wreck.

Remnant constituents from the ship's domestic assemblage encountered in the vicinity included a second steelyard (428 mm long), a copper cauldron (Fig. 3) and a pear-shaped lead counterbalance weight sheathed in copper. Once the bar of the larger steelyard was straightened, the condition of both this and the smaller weighing device proved remarkably fine. Accumulated encrustation was negligible and the state of all inscriptions, denoting the

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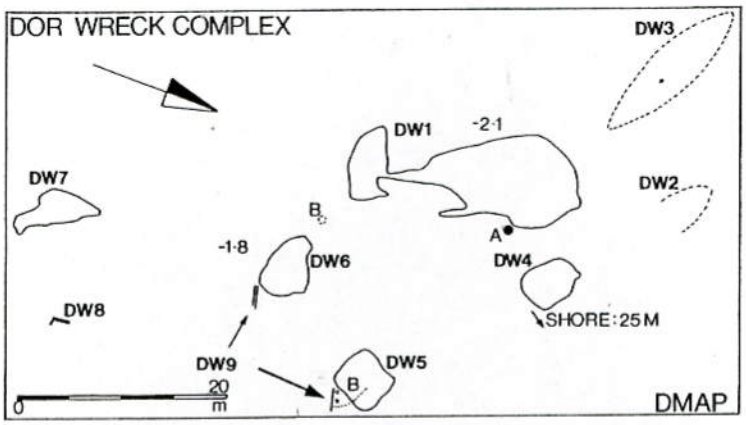

Figure 1. Plan of the Dor wreck complex as exposed in the summer/autumn of 1991. (Drawing: S. Kingsley & K. Raveh.)

name of the merchant operating from the vessel, formed by a series of small punch marks in the metal, remains clearly legible. Three inscriptions, flanked by the Christian sign of the Cross, refer to three successive owners and reflect the device's longevity. The inscriptions denote that at the moment when Dor G foundered, in the late 6th or early 7th century AD, both steelyards belonged to Artemon-Psates of Rhion (de la Presle, 1993)[1].

Dor wreck No. 6 (DW6/Dor F)

Amongst a 5·9 × 4·8 m continuous spread of wreckage concentrated at a depth of 1·8 m, the site is identified by the presence of two forms of ballast: amorphous white chalk rocks and well-cut slender rectangular ashlars composed of beachrock. The surface dimensions of the amorphous fill vary between 16 × 15 cm and 47 × 26 cm. The ashlar masonry dimensions also differ, ranging from 28 × 27 cm to 74 × 24 cm and are mainly oriented between 300 and 340°, indicating wreckage on a general north–south axis, the bows swept around parallel to the shore.

A single-hole stone anchor within the western perimeter of the wreck is a second distinctive feature of the site (Figs 4 and 5; Raveh & Kingsley, 1992: 314). The direction of the anchor and adjacent ashlar blocks correspond exactly, implying either storage in the hull or on an open deck alongside the ashlar ballast. Significantly, the chalk composition of both the amorphous ballast and the anchor seems identical[2].

Traces of wood splinters and small fragments of planks were recorded less than 2 m west of the anchor and concreted iron nails litter the surface of the entire site[3]. The fine condition of a 175 mm long and 92 mm rigging block with a concave frontal plane pierced with two tubular holes (Fig. 6) was stabilised through becoming

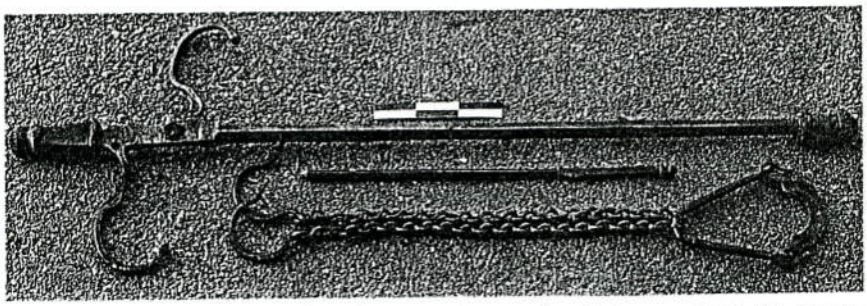

Figure 2. Two bronze steelyards and one set of suspension chains associated with Dor G. Scale: 15 cm. (Photo: S. Kingsley.)

Figure 3. Copper cauldron with handles from Dor G. 181 mm high. (Photo: S. Kingsley.)

trapped in a shallow, sand-filled hollow between two blocks of ballast. Both piercings and the channel around the sides of the block are covered with distinct traces of rope abrasion[4]. An iron hammer-head with a wooden shaft (Fig. 7) from a carpenter's chest appeared close to two red hearth-bricks, a flat galley roof-tile curved on the one surviving corner, and a lump of powdery fired concrete from the hearth structure.

The density of pottery overlying the site is greater than on the other wrecks surveyed in 1991, with amphora sherds from four principal

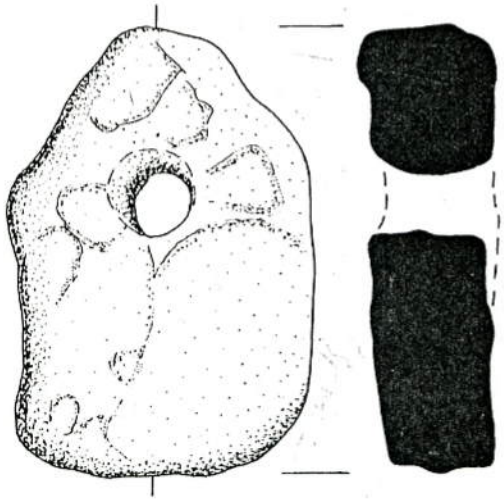

Figure 4. AN 018-1, a single-hole stone anchor from Dor F. Scale 1:10. (Original drawing by S. Kinglsey, final artistic rendition by D. Avni.)

Figure 5. Photograph of AN 018-1 from Dor F. Scale on anchor: 15 cm. (Photo: S. Kingsley.)

types dominant. The locally produced bag-shaped amphora (Zemer, 1977: 66–9; Peacock & Williams, 1986: 191–2) occurs with the greatest frequency, but the type's value as an index of chronology is complicated by the general shape which remained similar from the 5th century AD through to the mid-7th century AD. Five examples of this class were selected for removal from the wreck and typify late examples of the form with very narrow shoulder grooving and a low rim. The bag-shaped amphoras from Dor F are later variants of the examples from the Hippodrome at Caesarea Maritima (Riley, 1975: 26–7) and conform to the type recorded in levels of the first four decades of the 7th century AD in the Late Byzantine Building, also at neighbouring Caesarea (Adan-Bayewitz Type 1B in Levine & Netzer, 1986: 91).

The base of a thick-walled dark grey clay container retrieved from the middle of the site emitted an extremely powerful scent when in air. Although scientific analysis of the white powder and amber-coloured crystalline solid within the base has so far proven unsuccessful, the odour is highly reminiscent of the guava fruit which may have been carried in confiture form.

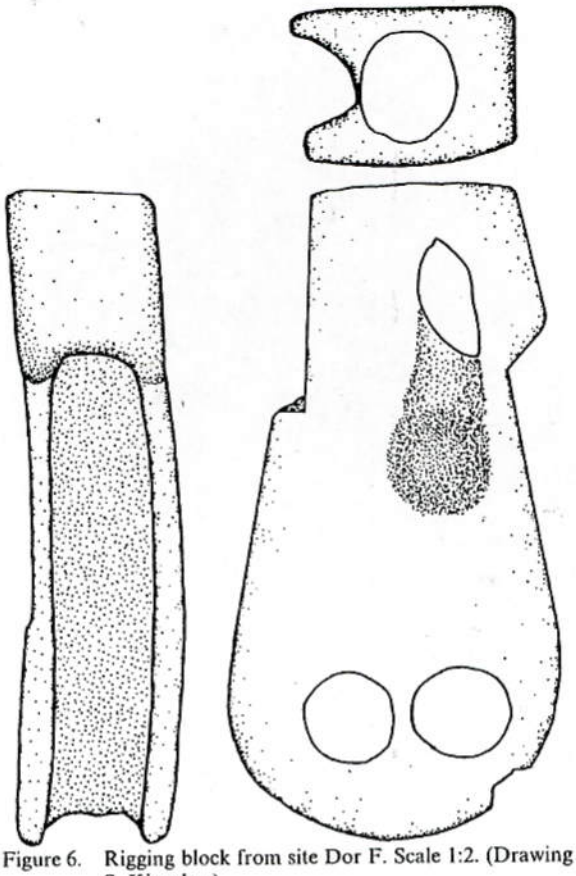

Figure 6. Rigging block from site Dor F. Scale 1:2. (Drawing S. Kingsley.)

The probability that Dor F grounded upon sand-banks, in the process of navigating the entrance to the natural harbour in stormy conditions during the first three decades of the 7th century AD, is substantiated by an extremely crushed and deteriorated copper flask (Fig. 8) retrieved from the north-eastern flank of the wreck. The container has a small, everted rim and an angular shoulder with a well-defined ridge where it meets the neck which is covered with a discontinuous series of short, intermittent linear incisions. An iron handle originally declined downwards from the neck to the top of the main body where it was attached to a heart-shaped lead plug. The flat base is composed of a piece of copper sheeting separate from the main body of the flask and meets the outer edge of the base at a tooth-shaped seam dovetailed together (Fig. 9).

In total, four comparable flasks from wreck locations are registered at south Dor (Raveh & Kingsley, 1991: 203). Such composite containers appear a typical trademark of Byzantine metallurgy, occurring in several 7th century AD contexts: a cauldron and pitcher from Yassi Ada A wrecked in, or slightly after, 625/6 AD (Bass & van Doorninck, 1982: 269–70), and a bowl and fragmentary container dated to around 630/1 AD from Grazel B at Gruissan in the south of France (Solier, 1981: 27–9). An intact, but undated example from the Hypostale Room in Delos (Deonna, 1938: 393) possesses tooth-shaped seams midway up the body and on the neck. A rich deposit of copper utensils from the Byzantine shops at Sardis in Turkey includes five flasks of the Dor type (some with iron handle attachments) which are dated through association with well-sealed coins to 615/6 AD (Stephens Crawford, 1990).

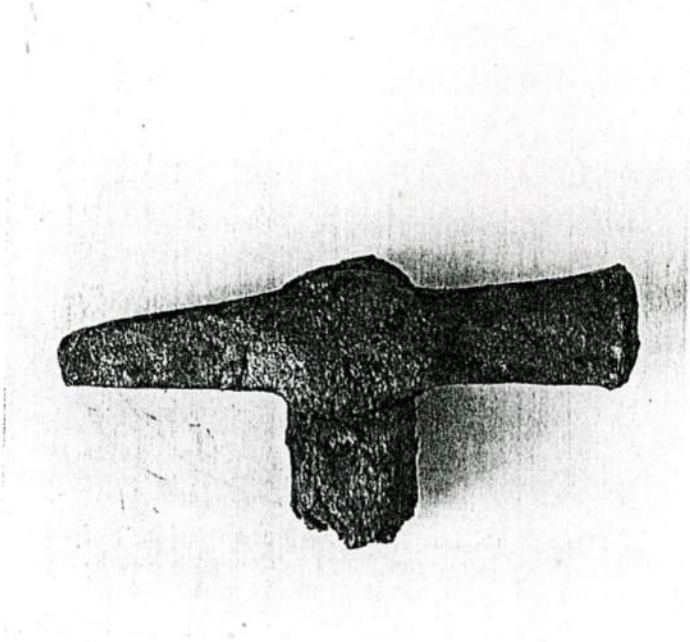

Figure 7. Hammer head from site Dor F. 71 mm long. (Photo: S. Kingsley.)

Later flasks, exemplified by two models from the first and second quarter of the 8th century AD from Pella in Jordan (Smith & Day, 1989: pls 38, 55 and 62), lack the characterizing tooth-shaped seams. Another, sealed in the Umayyad shops at Beit Shean in the Galilee by the earthquake of 18 January 749 AD (Tsafrir & Foerster, 1989/90: 127), is wider and more squat than the Dor flasks and, as at Pella, is composed of a single sheet of bronze.

Figure 8. Crushed copper pitcher from site Dor F. 233 mm long. (Photo: S. Kingsley.)

Dor wreck No. 4 (DW4/Dor D)

The 6·0 × 4·5 m spread of amorphous ballast stones exposed in 1991 attain average proportions of 50 × 50 cm and are composed of unusual marble schist blocks cut with crystalline calcite veins. The few fragments of pottery wedged between the ballast, at a spatial density as low as eight sherds per m^2, are all from bag-shaped amphoras in three hues of clay. With the exception of two red hearth-bricks and a single iron pick, the wooden shaft of which was retained in position by a small iron tack (Fig. 10), the surface of the wreck was artefactually bare. However, the overall dimensions of the spread of wreckage have not been satisfactorily identified.

At a location 10·5 m south of the south-western perimeter of Dor D, as noted in 1991,

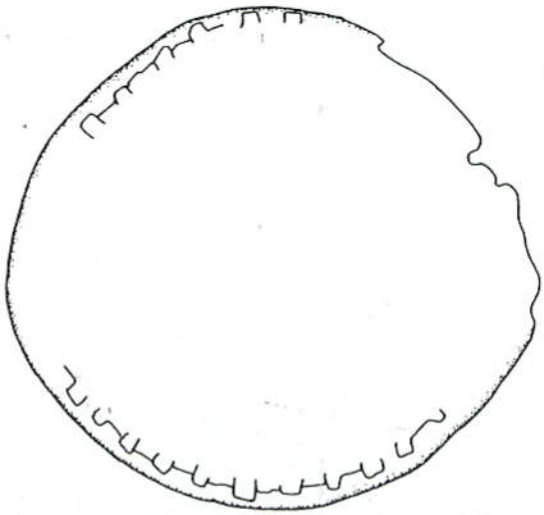

Figure 9. The base of the Dor F flask. Note the tooth-shaped seam. Scale 1:2. (Drawing: S. Kingsley.)

a group of three single-hole stone anchors are aggregated within a diameter of 1·4 m (A on Fig. 1; Figs 11–13). Two additional stone anchors observed on the northern flank of the site in 1990 suggest that the vessel may have been actively employing five such mechanisms in an attempt to control entry behind the islet chain in high seas[5].

The initial perception of the group may be credited to Shelly Wachsmann and Honor Frost who encountered another Byzantine copper flask and an open-sided copper bowl between the exposed anchors in the course of a routine survey for the Israel Department of Antiquities (now the Israel Antiquities Authority) in November 1981. The report prepared after the dive suggests the surrounding wreckage was sand-covered at that time.

Both copper containers and the large quantities of bag-shaped amphoras noticed beneath the anchors in 1991 may be considered spill from Dor A/DW1, a substantial Byzantine wreck which settled immediately west of the three anchors. The ballast from Dor A occurs less than one metre away from the anchor group. The proximity between the anchor group and the main ballast nucleus of Dor A initially influenced the impression that the anchors were directly related to this vessel. However, storage of the anchors on the starboard flank of Dor A does not make sense since it would have caused the ship to be overtly unbalanced and disproportionately weighted.

Although the relationship between the three stone anchors to the south and two the north of

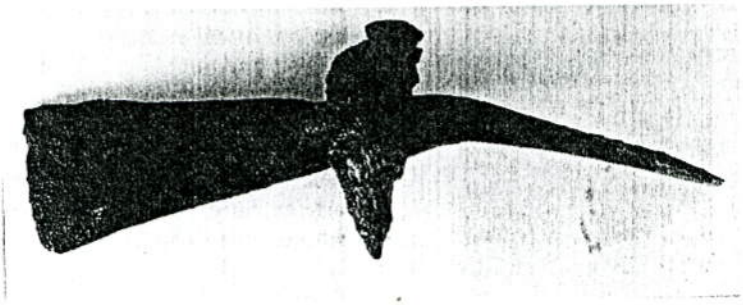

Figure 10. Iron pick from Dor D. (Photo: S. Kingsley.)

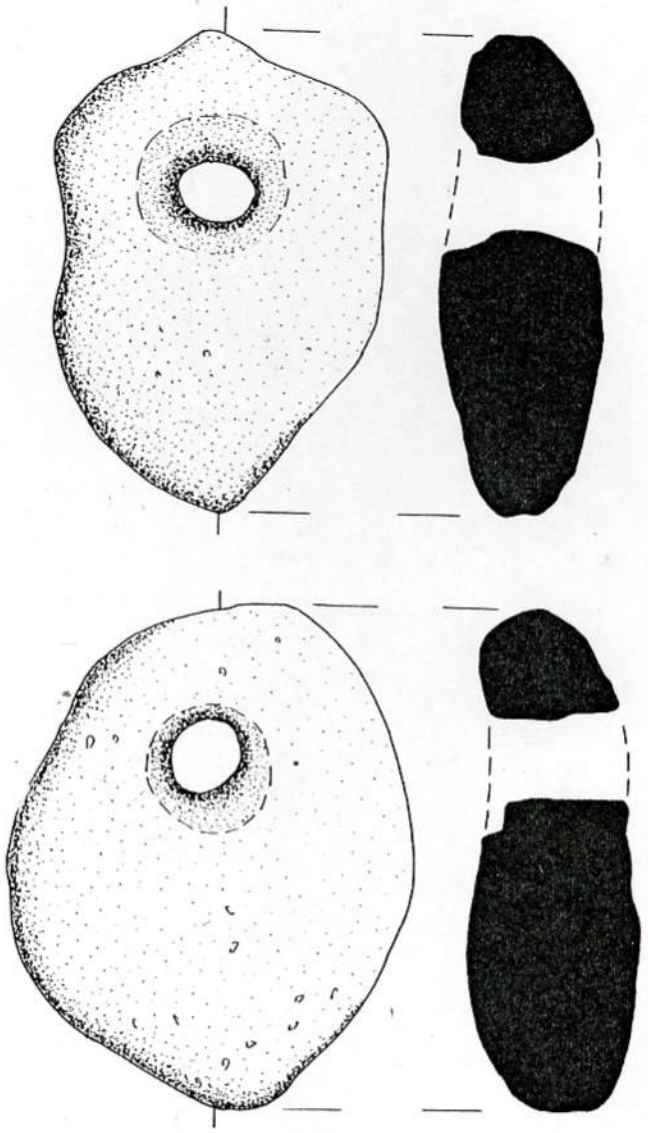

Figure 11. AN 023-2 (top) and AN 023-3 (bottom), single-hole stone anchors associated with Dor D. Scale 1:10. (Original drawing by S. Kingsley, final artistic rendition by D. Avni.)

Dor D cannot be firmly resolved without complementary excavation to determine the spacial configuration of wrecks Dor D and A, the levels and classic positions of the grouped anchors suggest that they are *in situ* components of Dor D's navigational equipment.

In contrast to the abraded pottery associated with Dor D, three areas of planking protruding from the sides of the ballast concentration were well preserved. Before manually concealing the wood, a 1·21 m section of a strake (B1) pointing downward into the sand alongside five planks toward the centre of the ballast heap was recorded (Fig. 14).

With a width of 202 mm and a thickness of 28 mm, rectangular mortise channels

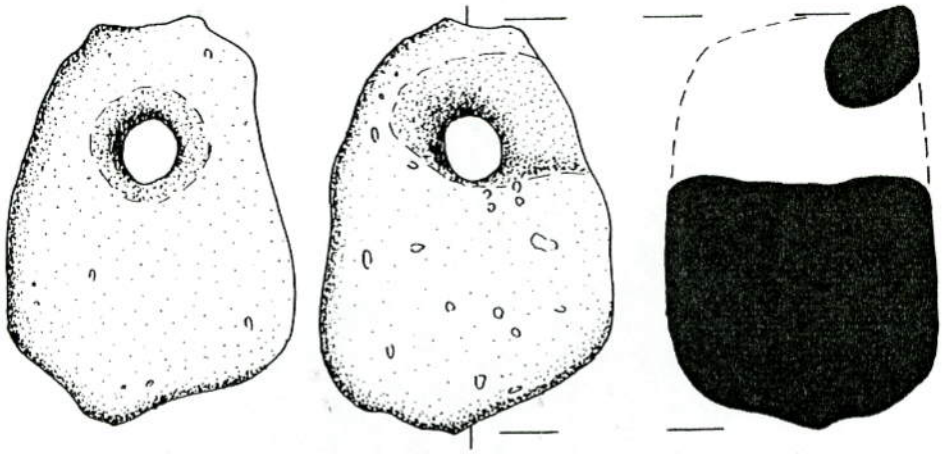

Figure 12. AN 023-1, a single-hole stone anchor associated with Dor D. Scale 1:10. (Original drawing by S. Kingsley, final artistic rendition by D. Avni.)

5 mm thick on average were staggered unequally along both edges of the cyprus wood (Cypressus sempervirens) of B1. The single exposed tip has a diagonally cut butt into the edge of which a single mortise is chiselled. The centre-to-centre distances between mortises vary between 225 and 367 mm, exceeding the intervals recorded on the late 3rd century AD Roman wreck in the port of Pommegues (Gassend, 1978: 103). Mortise spacing is closer to the mid-to-second-half of the 4th century AD Dramont F wreck where centre-to-centre distances vary between 190 and 360 mm (Joncheray, 1975: 126) and the 4th century Roman wreck at Yassi Ada where the most frequent recorded intervals range from 250 to 320 mm (van Doorninck, 1976: 123).

In contrast with the latter cases, tenons were in no case locked by treenails in B1, a feature analogous with the late 6th or early 7th century AD St Gervais vessel (Jezegou, 1985: 354), and early to mid-7th century AD contexts at Yassi Ada A (Bass & van Doorninck, 1982: 55) and Pantano Longarini (Throckmorton & Throckmorton, 1973: 263). The absence of treenails and wide mortise spacing favours a date in the 6th century AD or later. Radiocarbon analysis of the strake by Israel Carmi and Dror Segal at the Weizmann Institute of Science dated the wood sample no. RT-1539 to 1490 ± 40 BP which equates to AD 539–621.

Catalogue of the anchors

As a single group, the three anchors from Dor D are curious in respect of their clear dissimilarity in shape. All three forms bear little resemblance to traditional Mediterranean Middle/Late Bronze Age anchors. In contrast, AN 018-1 from Dor F, which occurs on the topmost level of a 6th–7th century AD wreck and is surrounded on all four flanks by Byzantine material, could be easily mistaken for an example of Bronze Age technology. The four anchors are yet to be precisely weighed, but are estimated at between 55–65 kg each.

Anchor A (AN 018-1)

A single-hole anchor composed of extremely soft, fine, white chalk. Discovered within the western perimeter of Dor F. The friable nature of the rock has caused the surfaces to deteriorate. All planes are water-worn and chipped. Length 61 cm, maximum width 42 cm, maximum thickness 19 cm. The inner diameter of the bi-conic piercing is 9 cm and the outer diameter is 12 cm.

Anchor B (AN 023-1)

A single-hole anchor of hard, dark grey beachrock. One of a group of three stone anchors associated with Dor D. Visually, the outer surface resembles the composition of basalt; the grey rock is punctuated with small cavities which are the result of post-depositional

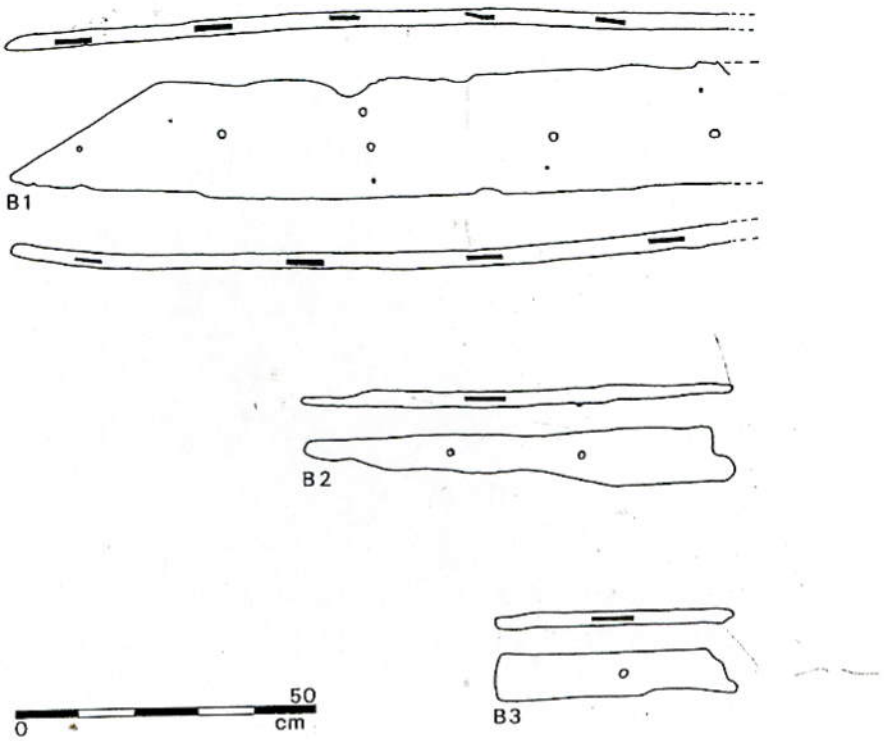

Figure 14. Wooden planking from the middle of Dor D. Strake B1 at top. (Drawing: S. Kingsley.)

bi-cupular piercing is 10 cm and outer diameter 17·6 cm.

Petrographic description

Samples of rock from the four stone anchors and from all concentrations of ballast within the Dor wreck complex were examined. With the exception of beachrock ballast from Dor A/DW1, none of the samples could be positively identified as indigenous to modern Israel[6]. The following petrographic description of the stone anchors is provided courtesy of Dr Porat of the Geological Survey of Israel:

(1) Anchor A (AN 018-1), site Dor F/DW6, sample no. PBS-11. Chalk. Completely bioturbated and recrystallized.

(2) Anchor B (AN 023-1), site Dor D/DW4, sample no. PBS-10. Beachrock. Highly porous biosparite. Large, recrystallized bioclasts. Benthic foraminifera, fragments of echinoderma, molluscs, gastropods, algae and corals. Cemented with coarse sparry calcite.

(3) Anchor C (AN 023-2), site Dor D/DW4, sample no. PBS-9. Limestone. Pelloids, large algae fragment, recrystallized molluscs and rare foraminifera cemented with sparry to micritic calcite.

(4) Anchor D (AN 023-3), site Dor D/DW4, sample no. PBS-8. Limestone. Completely recrystallized sparry limestone. Silification taking place. No original texture left.

Discussion

Traditionally, occurrences of stone anchors in contexts post-dating the introduction of the stone stock during the 7th century BC (Gianfrotta, 1977: 286; Frost, 1982: 269), with the exception of a few cases[7], are dismissed as reflections of the economic destitution of the anchor owner. During the Byzantine era, international vessels drawn to Dor seem to have regularly employed the T-shaped iron anchor and 20 such Late Roman/Byzantine pieces and three stocks have been recorded in the South

and Main Bays at Dor in the course of surveys between 1976 and 1991.

Analysis of the ballast and anchors from Dor D and Dor F failed to confirm the logical suspicion that the vessels were local craft with a restricted sailing capability. Although the sets of ashlar masonry within Dor F and Dor G suggest that both ships were involved in the movement of cheap building materials undoubtedly procured from a neighbouring coastal ruin, the two steelyards, cauldron and a pot lid from Dor A are typical of domestic assemblages observed on vessels capable of completing long-distance journeys and participating in international trade. Vestiges of a hearth and galley on Dor F also hint that the vessel was not confined to a purely regional capability.

Large quantities of locally produced bag-shaped amphoras associated with all three wrecks discussed in this paper emphasize that the ships were operating on a regional basis at the time of their demise. Sailing very close to shore and over a limited distance, the captains of Dor D, Dor F and perhaps Dor G, may have considered the short passages anticipated as low risk, enabling the relatively more valuable iron anchors to be safeguarded for future long-distant operations. A more spirited consideration of the relationship between the stone anchors and related ships will be presented in the final report on the Dor wreck complex.

Acknowledgments

The authors wish to express their gratitude to the following who were of great assistance during the 1991 survey season: Dvora Avni (administrative support and some scale drawings), Shalom Reuven, Moshe Lufan, Prof. Sol Bodner and Herma Slagman (all participant divers). Thanks are also due to the Israel Antiquities Authority for facilitating the radiocarbon analysis, to Dr Naomi Porat for dipping into somewhat unusual territory, and to Dr N. Lipshitz who identified the wood species from the ships.

The 1991 season was sponsored by the Schussheim Foundation in Haifa, Hy and Lorry Goldenberg, B. Shankerman, E. and R. Brenn, and was based at the Center of Nautical and Regional Archaeology Dor. Sean Kingsley received additional assistance from the Anglo-Israel Archaeological Society, the Academic Study Group in London and the Palestine Exploration Fund.

Notes

[1] According to de la Presle's detailed study of the two steelyards, Artemon-Psates is a name of Egyptian origin (1993: 580–8).

[2] Although the white chalk from which the Dor F anchor and amorphous ballast are composed seem visually identical, the sample from the anchor presented to the Geological Survey of Israel was too deteriorated for positive confirmation of the relationship.

[3] Throughout the Dor wreck complex, all encrustation coating nails and carpenter's tools contains perfectly preserved iron solids. This trend, typical of the Israel coast, contrasts with the voids encountered in encrustations on wrecks off Turkey and the south of France.

[4] A comparable rigging block from the bottom of the Adriatic harbour of Enona and dated to the second half of the 1st century AD is interpreted as a probable shroud tensioner (Brusic & Domjan, 1985: 81).

[5] The same anchor grouping pattern is observed on Dor G.

[6] Although only one set of ballast from the Dor wreck complex has been possibly identified as indigenous to the coast of Israel, the present writers are unwilling to conclude all the ballast deposits were gathered outside of Israel. Above Dor on the Carmel Mountain range, outcrops similar to stone samples from Dor A and the anchors from Dor D have been visually noted.

[7] According to Honor Frost, pyramidal stone anchors from Zea Liman and Magna Graecia may be derived from warships of the 5th–4th century BC (1985: 97–113).

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